# Heart Disease Community of Practice Series 3

## Diuretic management in an outpatient setting

Project ECHO
Palliative Care - Canada
BY Pallium Canada

Facilitator: **Diana Vincze, Pallium Canada**
Presenters: **Dr. Lynn Straatman, MD FRCP**
**Morgan Krauter, NP, CCN(C)**

Date: **11 December 2024**

# Territorial Honouring

# The Palliative Care ECHO Project

The Palliative Care ECHO Project is a 5-year national initiative to cultivate communities of practice and establish continuous professional development among health care providers across Canada who care for patients with life-limiting illness.

**Stay connected: www.echopalliative.com**

The Palliative Care ECHO Project is supported by a financial contribution from Health Canada. The views expressed herein do not necessarily represent the views of Health Canada.

Health Canada Santé Canada

Project ECHO Palliative Care - Canada BY Pallium Canada

# Introductions

## Facilitator

**Diana Vincze**
Palliative Care ECHO Project Manager, Pallium Canada

## Presenters

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Department of Medicine (Cardiology and Palliative Care)
Department of Pediatrics (Adolescent Health)
Medical Director, Cardiac Function Clinic

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Nurse Practitioner, Heart Function Program
Royal Victoria Regional Health Centre, Barrie, ON
Adjunct Faculty Member, Lawrence S. Bloomberg Faculty of Nursing, University of Toronto

# Introductions

## Panelists

**Dr. Caroline McGuinty, MD FRCPC**
Cardiologist, Advanced Heart Failure and Transplantation, Cardiac Palliative Care
University of Ottawa Heart Institute
Assistant Professor, University of Ottawa

**Dr. Michael Slawnych, MD FRCPC**
Clinical Assistant Professor
Department of Cardiology, St Paul's Hospital
University of British Columbia

**Dr. Leah Steinberg, MD, CFPC, FCFP, MA**
Palliative Care Clinician, Sinai Health System
Assistant Professor, Division of Palliative Care, University of Toronto

**Drew Stumborg, RN**
Saskatchewan Health Authority

**Shannon Poyntz, NP-PHC, MN**
Nurse Practitioner, Supportive Care

# Disclosure

Relationship with Financial Sponsors:

**Pallium Canada**

- Not-for-profit
- Funded by Health Canada
- Boehringer Ingelheim supports Pallium Canada through an in-kind grant to expand interprofessional education in palliative care.

# Disclosure

**This program has received financial support from:**

- Health Canada in the form of a contribution program
- Pallium Canada generates funds to support operations and R&D from Pallium Pocketbook sales and course registration fees
- An educational grant or in-kind resources from Boehringer Ingelheim.

**Facilitator/ Presenter/Panelists:**

- Diana Vincze: Palliative Care ECHO Project Manager at Pallium Canada.
- Morgan Krauter: Novartis, Pfizer (speaker fees); Alleviant (consulting fees).
- Dr. Michael Slawnych: Novartis.
- Dr. Leah Steinberg: Pallium Canada (education material), HPCO (clinical advisory committee, educator).
- Dr. Caroline McGuinty: Servier (consulting fees), Novartis (speaker fees).
- Dr. Lynn Straatman: Servier, Novartis, Astra Zeneca, BI, Medtronic, Pfizer, Eli Lilly, Bayer, Merck (clinical trials).
- Shannon Poyntz: None to disclose.
- Drew Stumborg: None to disclose.

# Disclosure

## Mitigating Potential Biases:

- The scientific planning committee had complete independent control over the development of program content

# Welcome and Reminders

- Please introduce yourself in the chat!
- Your microphones are muted. There will be time during this session for questions and discussion.
- You are also welcome to use Q&A function to ask questions.
- Add comments or to let us know if you are having technical difficulties; feel free to raise your hand!
- This session is being recorded and will be emailed to registrants within the next week.
- Remember not to disclose any Personal Health Information (PHI) during the session.
- This 1-credit-per hour Group Learning program has been certified by the College of Family Physicians of Canada for up to **6 Mainpro+** credits.
- This event is also an Accredited Group Learning Activity through the Royal College of Physicians and Surgeons of Canada. You may claim a maximum of **6.00 hours.**

# Objectives of this Series

**After participating in this program, participants will be able to:**

- Describe what others have done to integrate palliative care services into their practice.
- Share knowledge and experience with their peers.
- Increase their knowledge and comfort around integrating a palliative care approach for their patients with advanced heart failure.

# Overview of Topics

| Session # | Session title | Date/ Time |
|---|---|---|
| Session 1 | Collaboration Building: How to build collaboration with teams in your setting | October 2, 2024 from 12-1pm ET |
| Session 2 | Diuretic management in an outpatient setting | December 11, 2024 from 12-1pm ET |
| Session 3 | Challenging conversations | February 5, 2025 from 12-1pm ET |
| Session 4 | De-prescribing cardiac and other medications: palliative care in people with advanced heart failure | April 30, 2025 from 12-1pm ET |
| Session 5 | Non ischemic causes of heart failure | June 25, 2025 from 12-1pm ET |
| Session 6 | Interaction of heart failure and lung disease | August 20, 2025 from 12-1pm ET |

# Objectives of this Session

**After participating in this session, participants will be able to:**

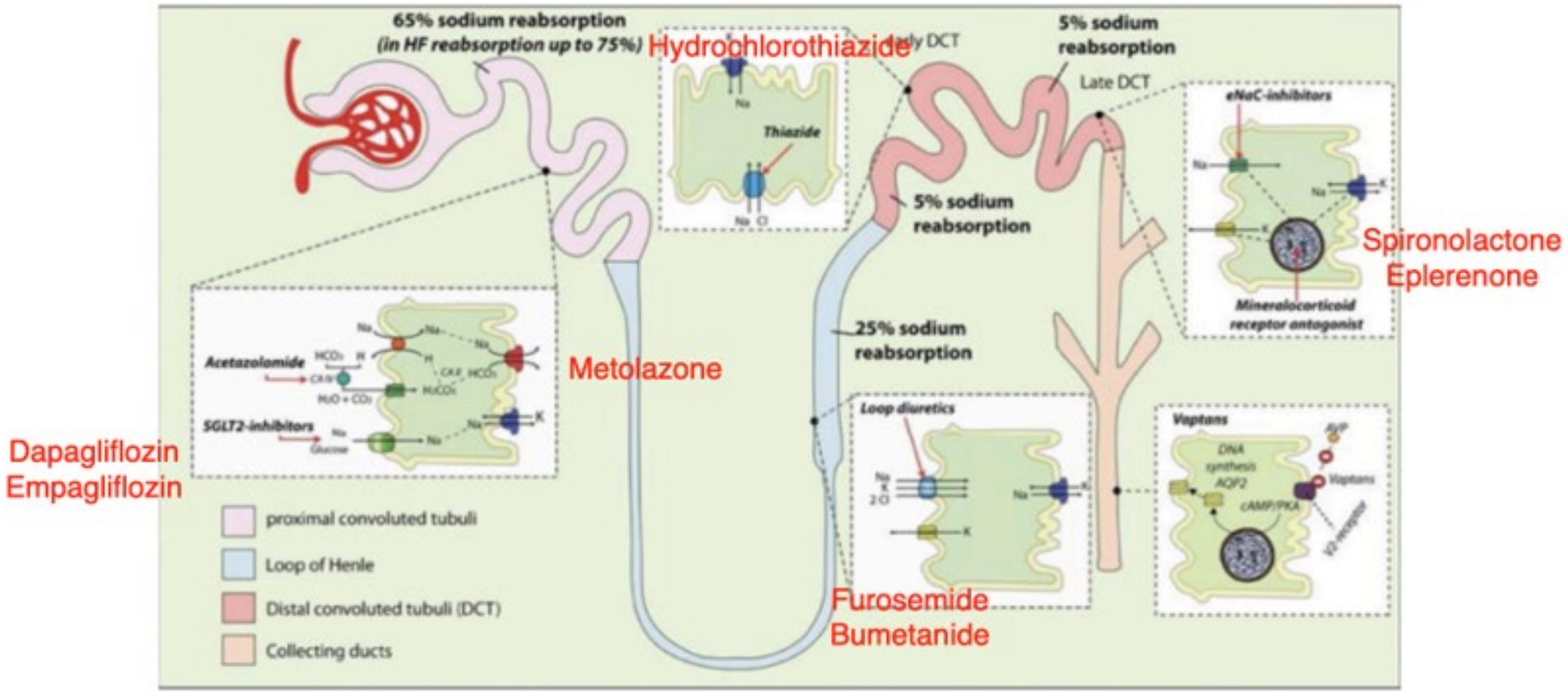
- Increase their knowledge and skill in using diuretics in the community.
- Learn about the use of diuretic medications during sick days.
- Apply diuretic protocols in their practice, including long-term care.

# Diuretic management in an outpatient setting

# Let’s talk about diuretics first

# Pharmacological Treatment of Volume Overload

- Diuretic therapy
- Vasodilators
  - ACE/ARB/ARNI
  - Nitroglycerin
  - PDE5 inhibitors




European J of Heart Fail, Volume: 21, Issue: 2, Pages: 137-155, First published: 01 January 2019, DOI: (10.1002/ejhf.1369)

# Loop Diuretics

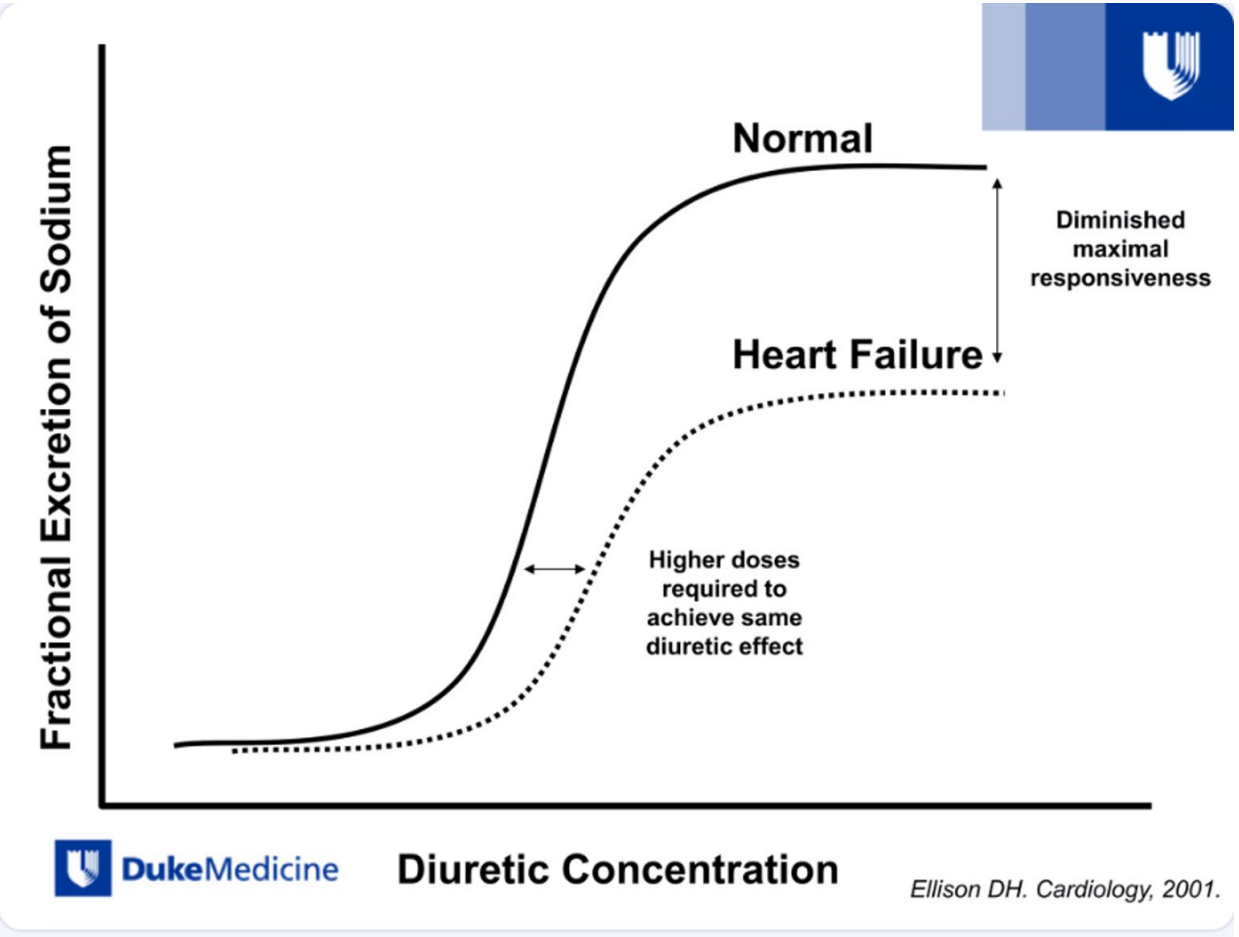
## Furosemide (Lasix), Bumetanide (Bumex)

- Highly protein-bound organic anions secreted across the proximal convoluted tubule where they act on sodium-potassium chloride channel in thick ascending loop of Henle to inhibit Na+ reabsorption to promote delivery of Na+ to distal tubule

- Steep dose-response curve and threshold dose below which they do not produce natriuresis.

- “High ceiling” diuretics: progressive increase in their dose promotes more natriuresis but after certain maximal dose the effect plateaus.

# Loop Diuretics




- Loop diuretics are “threshold drugs”.
- Appropriate dose is required to achieve therapeutic effect.
- HF shifts dose-response curve, requiring higher start dose to achieve same level of Na+ excretion.

# Loop diuretic resistance in HF

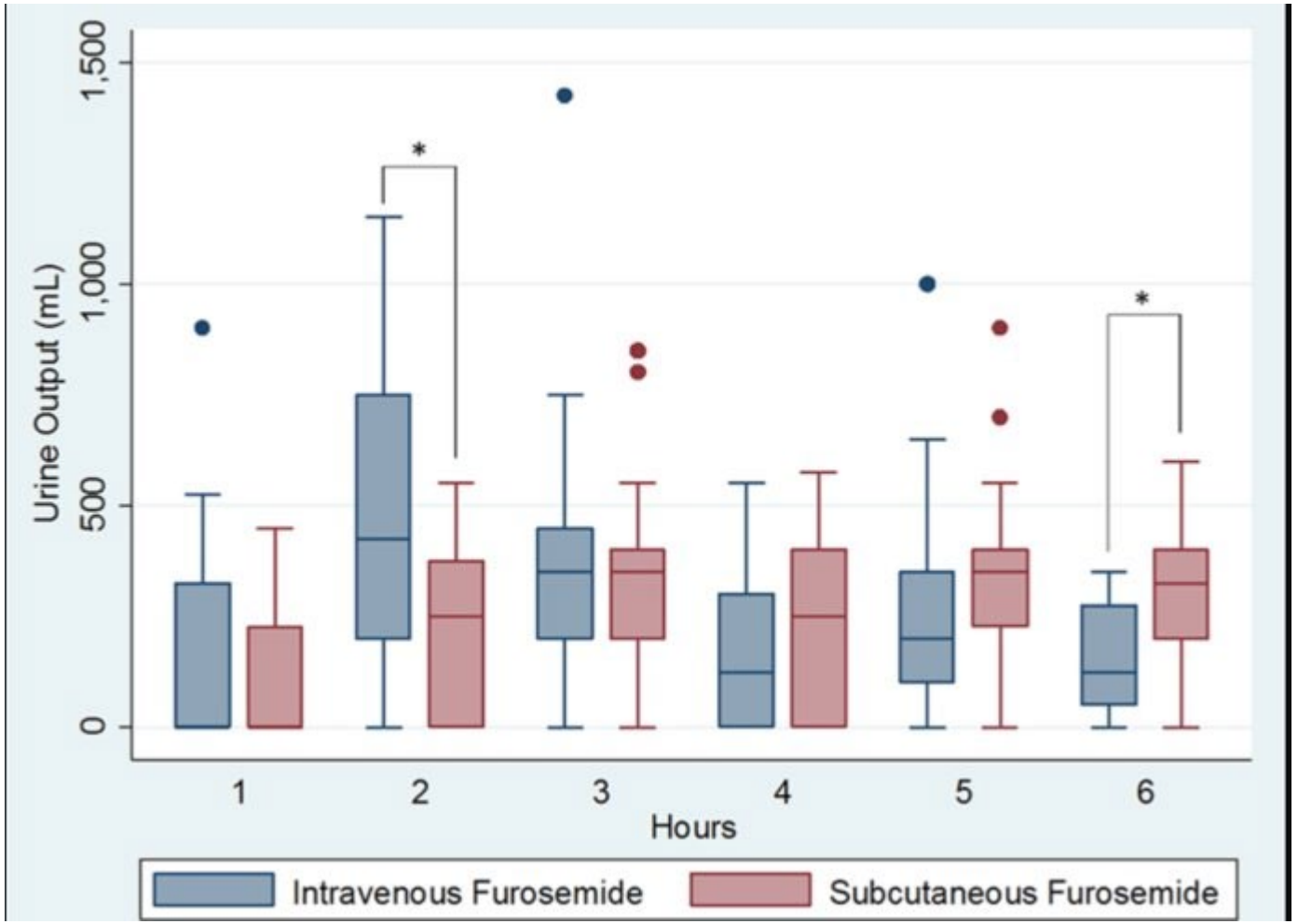
- Heavily protein-bound (> 90%) and requires sufficient plasma levels as renal perfusion is often reduced in HF, resulting in decreased secretion of loop diuretics.
- Also impacted by decreased plasma protein content in cachexia / malnutrition.
- Bioavailability is highly variable for oral furosemide and determined by gastrointestinal tract absorption, which is impaired by reduced cardiac output and bowel edema.
- Chronic use of loop diuretics induces compensatory distal tubular sodium reabsorption through tubular cell hypertrophy, leading to reduced natriuresis and need for progressive dose increase over disease course.

# Furosemide vs. Bumetanide

| Characteristics | Furosemide (Lasix) | Bumetanide (Bumex) |
|---|---|---|
| Half-life (hours) | 1.5-2 | 1-1.5 |
| Bioavailability | 10-100 | 80-100 |
| Initial oral dosing (mg) | 20 - 40 | 0.5 – 1 |
| Relative potency | 40 | 1 |
| IV to oral dosing | 1:2 | 1:1 (IV not available in Canada) |
| Maximum dosing in 24 hours (mg) | 600 | 10 |
| Duration of effect (hours) | ~ 6 | 4-6 |

**Efficacy of Intravenous Furosemide Versus a Novel, pH-Neutral Furosemide Formulation Administered Subcutaneously in Outpatients With Worsening Heart Failure**

**JACC: Heart Failure, Volume 6, Issue 1, January 2018, Pages 65-70**



# Heart Failure@ Home Pathway for Outpatient IV diuretics

**Table 3** Treatment episodes

| | Inpatients (*n*) | HeartFailure@Home | | |
|---|---|---|---|---|
| | | All | Day unit | Home IV |

**Table 4** Follow-up data

| | In patients | HeartFailure@Home | | |
|---|---|---|---|---|
| | | All | Day unit | Home IV |
| HFH or death within 30 days of end of episode | 29/89 (32.6%, 12 HFH, 19 deaths) | 20/114 (17.5%) | 15/78 (19.2%, 14 HFH, 2 deaths) | 5/36 (13.9%, 3 HFH, 2 deaths) |
| HFH or death within 12 months of end of episode | 60/89 (67.4%, 38 HFH, 34 deaths) | 61/114 (53.5%) | 45/78 (57.7%, 25 HFH, 28 deaths) | 16/36 (44.4%, 9 HFH, 11 deaths) |
| Died during episode | and seven unexpected) | | | |

HFH, heart failure hospitalization; HF@H, Heart Failure at Home service.

Data available for all episodes unless otherwise stated.
[a]Six patients used both home IV and day unit for different episodes.
[b]Some patients experienced more than 1 complication (e.g. hospitalized and then died)
[c]Ten for higher dose diuretics and one due to transport issues.
[d]Hyponatraemia, higher dose diuretics.

Blood tests (unless stated otherwise)

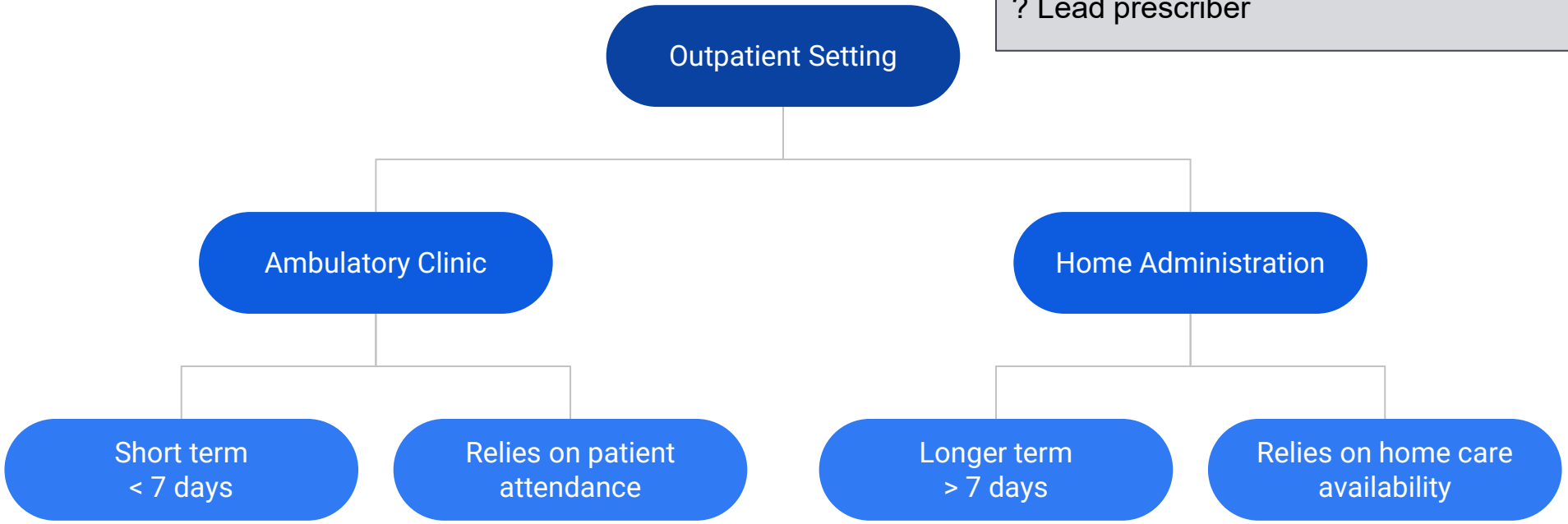
Blood tests ± specialist review

Ahmed FZ, Taylor JK, John AV, et al. Ambulatory intravenous furosemide for decompensated heart failure: Safe, feasible, and effective. *ESC Heart Failure*. 2021;8(5):3906-3916. doi:10.1002/ehf2.13368

# Outpatient IV Lasix

**Questions to consider:**

? Symptom severity
? GOC: active medical management vs. palliative
? Local resource availability: home care nurse, community paramedics, lab services, geography
? Reassessment method: in-person, video, telephone
? Lead prescriber



# Carbonic Anhydrase Inhibitor

Acetazolamide (Diamox)

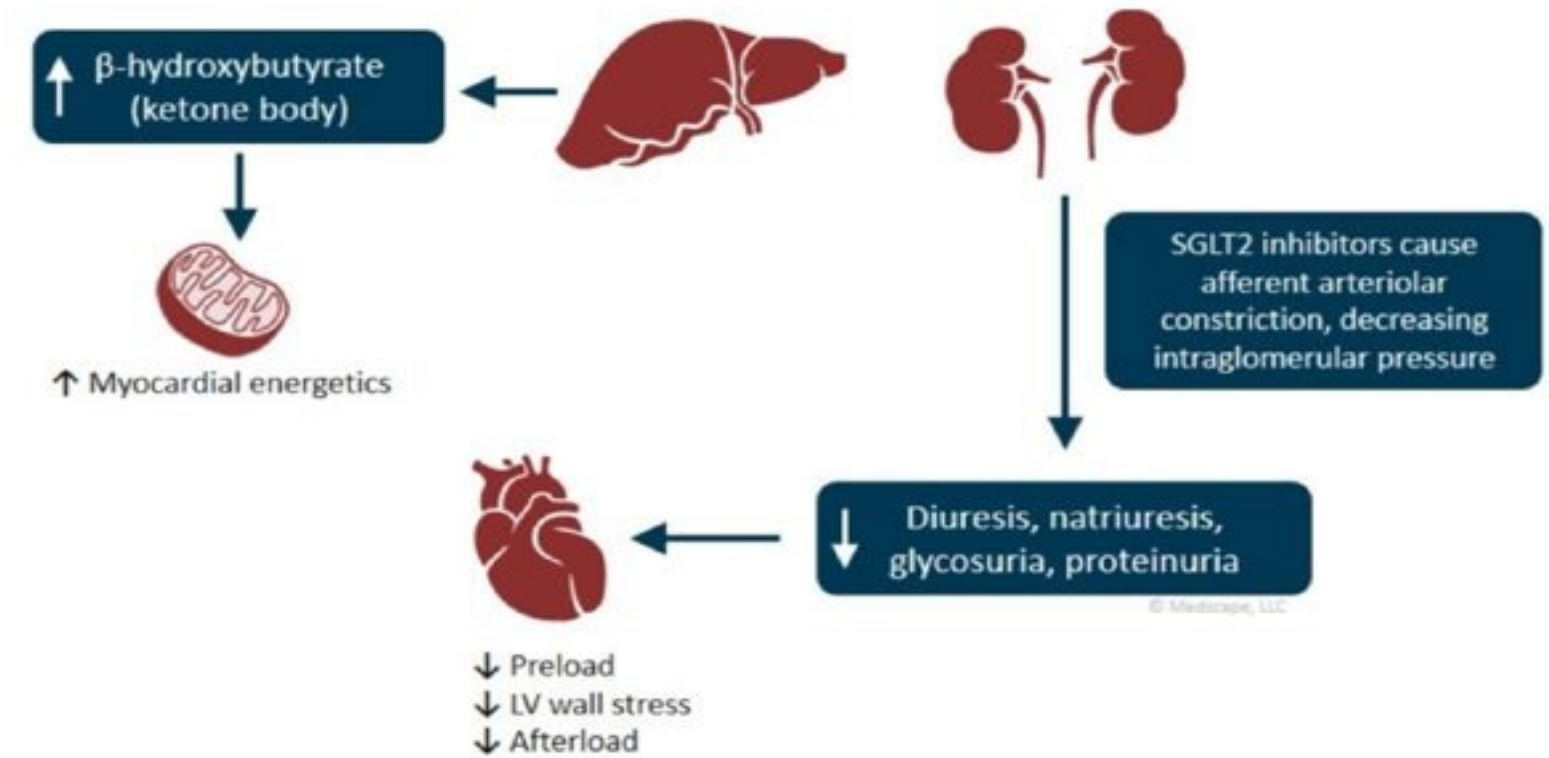
- Acts on proximal convoluted tubule to inhibit sodium reabsorption.
- According to ADVOR (2022) trial, addition of acetazolamide (500mg IV daily) to standardized IV loop-diuretic therapy associated with higher incidence of successful decongestion within 3 days after randomization.
- Practical dosing: acetazolamide 250-500mg PO BID in combination with PO or IV loop diuretic therapy.

## Sodium-Glucose Linked Transporter-2 Inhibitors (SGLT2)

**Empagliflozin (Jardiance), dapagliflozin (Farxiga), canagliflozin (Invokana)**

- Inhibit proximal sodium absorption.
- Modest natriuretic effect of SGLT2 in addition to loop diuretics from glucosuric effect.
- Disease modifying therapeutic agent in symptomatic patients with chronic HFrEF.
- Decreases magnesium excretion and increased uric acid excretion and not known to worsen renal potassium excretion like loop diuretics.

# SGLT2 Inhibition in HF




Lam CSP, et al. *J Am Heart Assoc*. 2019;8:e013389.

| Diuretic Class | | Dose Range (daily) | Bioavailability | Onset of Action |
|---|---|---|---|---|
| **Loop (Act on the loop of Henle)** | Furosemide (Lasix) | 20 - 360 mg | 10 - 100% | PO - 30 -90 minutes<br>IV - 30 -60 minutes<br>SC - 30 - 90 minutes |
| | Bumetanide (Bumex) | 1 - 8 mg | 80 -100% | PO - 30 -90 minutes |
| **Mineralocorticoid** | Spironolactone | 12.5 - 50 mg | 60-90% | Up to 48 hours |
| | Eplerenone (Inspra) | 12.5 - 50 mg | 60-90% | Up to 4 weeks |
| **Thiazide** | Hydrochlorothiazide | 12.5 - 25 mg | 65-70% | 1 to 5 hours |
| **Other** | Metolazone (Zaroxlyn) | 2.5 - 10 mg | | Does not work alone<br>Needs to be given with Loop Diuretic |
| | Acetalzolamide | 250-375mg | | 1 to 2 hours |

# Nitrates

- Potential mechanisms:
  - Nitroglycerin increases the number of patent capillaries thereby improving microcirculation.
  - May improve myocardial stress.
  - Vasodilatory effect may:
    - Induce a substantial reduction in RV and LV filling pressures.
    - Decrease systemic and pulmonary vascular resistance, as well as lower systolic BP (SBP) which leads to a downward shift of the ventricular pressure and volume relationship, such that the same volume has lower filling pressures, and myocardial efficiency improves.

# Case-Based Discussion

# Case Study 1

## IVAN

- 66 year old male with a history of
  - Myocardial Infarction in 2011 and 2012
  - CABG 2012, complicated by heart failure (LVEF 25% since 2012)
  - AICD since 2013
  - Multiple hospitalizations for CHF (3 in the last 6 months)
  - Medications:
    - Lasix 80 mg BID
    - Coreg 25 mg BID
    - Ramipril 10 mg OD
    - Aldactone 12.5 mg OD

- On exam
  - HR 68 bpm, BP 112/76 mmHg, RR 18
  - JVP 8 cm ASA, positive AJR
  - 4+ pitting edema to mid thigh
  - Decreased air entry bilaterally at bases with crackles throughout the chest
- What to do?

# Volume Overload

- Treatment
  - Non-pharmacological
    - Daily weights with lasix sliding scale
    - Fluid restriction (1.2-1.5 L/day)
    - Salt restriction (2g/day)

# Results

## IVAN

- Fluid Restriction 1.5 litres/day
- Salt Restriction 2 gm/day
- Metalazone 5 mg ½ hour prior to lasix for 3 days and then 2 times a week
- Lasix 120 mg BID for one week
- Renal Function and Electrolytes in one week
- What Happened?
  - Lost 7 kg in the first week and felt much better
  - Creatinine rose from 136 to 160 week 1 and stabilized at 145 week 2 and 3.

# 3 months later

## IVAN

- Ivan now is again presenting with volume overload
- Current diuretics are:
  - Lasix 120 mg BID
  - Metalazone 5 mg (1/2 hour prior to am lasix) twice per week
- Labs
  - Creatinine 245, Na 129, K 4.8

- What would you consider now?

## IVAN

- Switch Lasix 120 mg BID to Bumex 4 mg BID
- Metalazone 5 mg for three days and then 3 times per week
- Consideration of 3 days of daycare for IV lasix with metalazone
- Discontinue Ramipril, Start Hydralazine/NTG

# Home IV Lasix

- Considered when failure of response to oral diuretic escalation or recurrent decompensated HF when attempting to wean from IV (presenting over days to weeks).

- Resource intensive
  - Lead-prescriber: NP, cardiologist vs. palliative care vs. primary care
  - RN coordinators from lead-clinic
  - IV Lasix administrators in the home: home care nurse vs. community paramedic vs. patient/caregivers
  - Pharmacy delivery
  - Lab monitoring coordinating
  - Escalation protocols and need for real-time access to prescribers

# The Toronto Diuretic Protocol in End Stage H


**ASSESSMENT**

On history ask about:
- Medication non-adherence
- High salt
- Infection
- NSAIDs

On exam:
- Increased JVP
- Rales
- Increased peripheral edema
- PICC line

**Heart Failure Decompensation**

- No → **Leave protocol**
- Uncertain → **Initiate RN daily monitoring x 7 days**
- Yes → **MANAGEMENT**

If HF decompensatio

**MANAGEMENT**

1. **Order:** RN to monitor symptoms, vitals, ± weight, and call MD daily x 7 days (see order template *link)*
2. **Consider:** Labwork, dietary counseling, foley catheter, IV line, IV supplies
3. **Escalate diuresis:** See next step for outline, page 2 for details
4. **Consider:** Call to cardiologist to inform

**Escalation of Oral Therapy**

Consider escalation of oral therapy if:
- Success with previous oral escalation
- Patient preference
- Bridging to delivery of intravenous therapy

Oral escalation guidelines - See next page

**Initiate Intravenous Therapy**

Consider IV if:
- Unresponsive to previous oral escalation
- Already on high dose therapy (>200 mg/day)
- Known resistance to diuretics
- Renal insufficiency
- Shortness of breath at rest

4-day IV dosing guidelines - See next page

**Symptom improvement**

- No → **SYMPTOMS NOT IMPROVED**
  Based on Goals of Care consider:
  - Reassessment in HF clinic
  - ED/Inpatient management
  - Transition of therapy to end-of-life pathway
- Yes → **SYMPTOMS IMPROVED**
  - Supplement K
  - Resume previous PO furosemide dose
  - Consider increasing PO furosemide dose
  - PICC line if anticipate reoccurrence

**Escalation of Oral Therapy**

| Suggested dose increases | |
|---|---|
| **Current Daily Dose** | **Suggested New Dose** |
| <40 mg/d | 40 mg BID |
| 40 to 120 mg/d | 80 mg qAM/40 mg qPM<br>80 mg BID |
| 120 to 240 mg/d | 120-160 mg BID<br>Consider add on therap |
| >240 mg/d | 160 mg BID<br>Consider add on therap |
| **Day 3-5 Reassessment** | |
| Weight Decreasing<br>Patient improving | Continue current dose<br>Administer kdur<br>May resume previous<br>therapy dose |
| Weight Unchanged or Increasing | Continue current dose<br>Consider add on therap |
| **Day 7 Reassessment** | |
| Weight Decreasing<br>Patient improving | Continue current dose<br>Administer kdur<br>May resume previous<br>therapy dose |
| Weight Unchanged or Increasing | Increase current dose<br>Consider add on therap<br>Consider IV diuresis |

| Add on therapies to consider | |
|---|---|
| Metolazone | 2.5-5mg/d x 3 days<br>2.5-5mg/d, M, W, F<br>Metolazone can be very effective<br>Limit to short, 3 dose tri<br>and reassess |
| Hydrochlorthiazide | 12.5-50 mg/d |

**Initiate Intravenous Therapy**

| Day 1 | |
|---|---|
| **Current Daily Dose** | **Suggested New Dose** |
| ≤120 mg/day<br>>120 mg/day | 40 mg IV BID<br>80 mg IV BID<br>Consider add on therapy |
| **Day 2 Reassessment** | |
| Weight Decreasing<br>Patient improving | Continue current dose<br>Administer kdur |
| Weight Unchanged or Increasing | Continue current dose<br>Consider add on therapy |
| **Day 3 Reassessment** | |
| Weight Decreasing<br>Patient improving | Continue current dose<br>Administer kdur<br>Can consider stepping down to PO |
| Weight Unchanged or Increasing | Increase 40 BID to 80 IV BID<br>Increase 80 BID to 120 IV BID<br>Consider add on therapy |
| **Day 4 Reassessment** | |
| Weight Decreasing<br>Patient improving | Continue current dose<br>Administer kdur<br>Can consider stepping down to PO |
| Weight Unchanged or Increasing | Increase 40 BID to 80 BID<br>Increase 80 BID to 120 BID<br>Consider add on therapy<br>Can continue beyond 4 days |

| Add on therapies to consider | |
|---|---|
| Metolazone | 2.5-5mg/d x 3 days<br>2.5-5mg/d, M, W, F<br>Metolazone can be very effective<br>Limit to short, 3 dose trials and reassess |

**Y AT ANY**

- Total of 6 days of therapy without symptomatic response

**Subcutaneous furosemide therapy**

| Furosemide can be administered subcutaneously if necessary. It is not first line of response, IV is preferred. If IV is not possible use subcutaneously. | |
|---|---|
| Concentration | 10mg/mL<br>Available in 2 and 4 mL vials |
| Options | Direct injection – may need multiple injections<br>CADD pump at 10-20mg/hr |

# Home IV Lasix Options

Length of treatment:
- 3-7 days
- 1-2 weeks
- 3+ weeks

TBD:
- to wean or not to wean
- weaning plan

## Daily

- Once a day IV Lasix administration by peripheral IV (< 7 days) or PICC (> 7 days).
- Nurse/CP/Patient/Caregiver administers via gravity or slow push.
- +/- Daily self-monitoring of weights, vitals, symptoms.
- +/- Weekly labs monitoring + PRN.

## Twice a Day

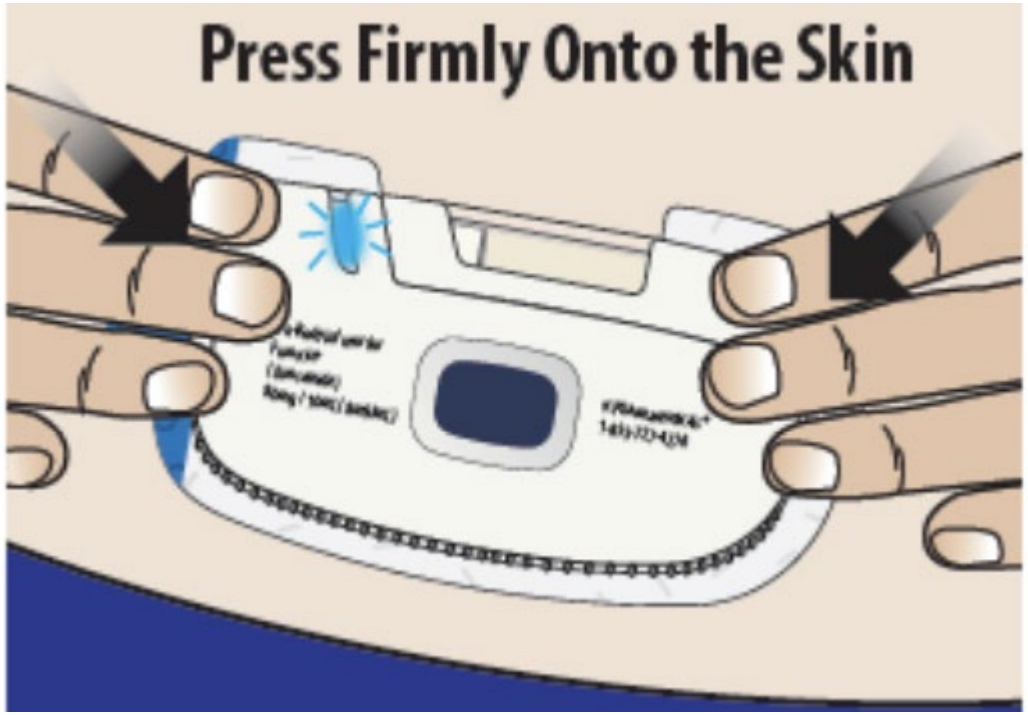
- BID IV Lasix administration by peripheral IV or PICC.
- Can be on CADD pump vs. push.
- +/- Daily self-monitoring of weights, vitals, symptoms.
- +/- Weekly labs monitoring.
- Can consider IV AM/PO PM.

## Infusion

- IV Lasix infusion via PICC on CADD pump.
- ?Increased tolerance by avoiding symptomatic hypotension with bolus dosing.
- Voiding 24hrs.
- +/- Daily self-monitoring of weights, vitals, symptoms.
- +/- Weekly labs monitoring.

*all require peripheral access-related care

# The Future? - Wearable SC Lasix Infusion




**Furosemide 80 mg over 5 hours**

# CENTRAL ILLUSTRATION: AT HOME-HF Phase 2 Pilot Study


**AT HOME-HF Phase 2 Pilot Study**
**SC Furosemide vs Usual Care**

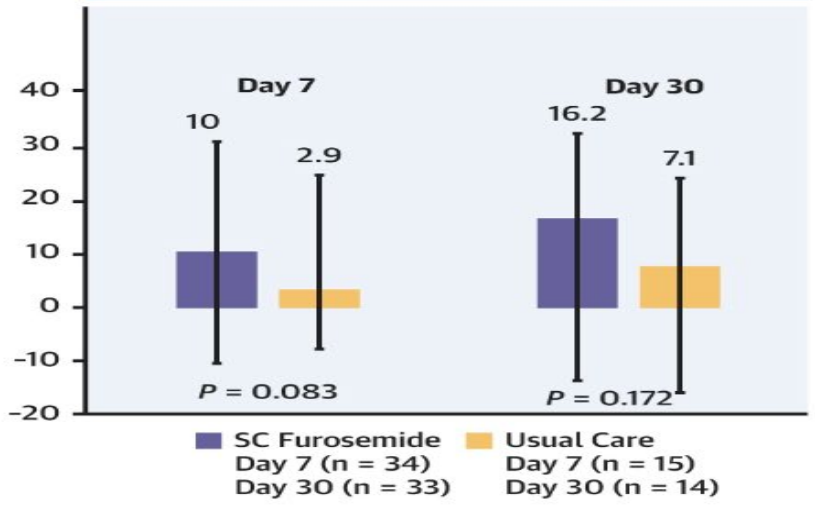
**SC Furosemide vs Usual Care**

**Primary Endpoint**
Win ratio: 1.11
(95% CI: 0.48-2.50;
*P* = 0.806)

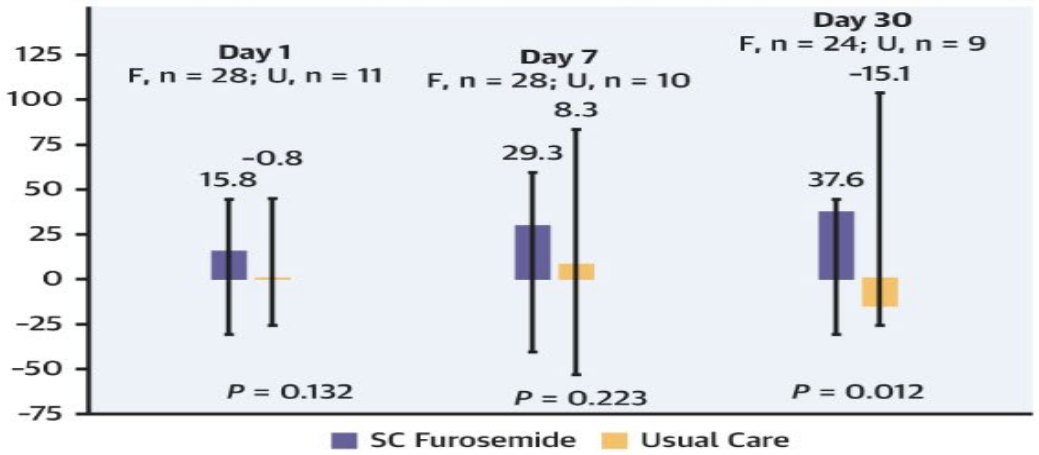
| Mean Weight Change From Baseline (kg) | | | | | |
|---|---|---|---|---|---|
| Study Day | 1 | 2 | 3 | 17 | 30 |
| Patients evaluated (F, U) | 34, 16 | 32, 14 | 32, 15 | 32, 15 | 31, 13 |
| SC furosemide (n = 34) | −2.0 | −3.1 | −2.9 | −3.8 | −3.1 |
| Usual care (n = 17) | −0.6 | −0.9 | −0.4 | −1.5 | −2.1 |
| *P* value | 0.07 | 0.06 | 0.04 | 0.07 | 0.34 |

| 7-Point Dyspnea Scale: Patients (%) Moderately or Markedly Better | | | | | |
|---|---|---|---|---|---|
| Study Day | 1 | 2 | 3 | 17 | 30 |
| Patients evaluated (F, U) | 34, 16 | 33, 14 | 32, 15 | 32, 16 | 33, 14 |
| SC furosemide (n = 34) | 32.3 | 35.3 | 44.1 | 52.9 | 55.8 |
| Usual care (n = 17) | 11.8 | 11.8 | 5.9 | 29.4 | 29.4 |
| *P* value | 0.003 | 0.010 | 0.006 | 0.162 | 0.135 |

**Mean (± SD) Δ in Baseline in KCCQ-12 Overall Summary Score**




**Mean (± SD) in Δ Baseline in 6MWD, m**




Konstam MA, et al. JACC Heart Fail. 2024;12(11):1830–1841.

# Questions?

# Wrap Up

- Please fill out the feedback survey following the session! Link has been added into the chat.
- A recording of this session will be e-mailed to registrants within the next week.
- Please join us for the next session in this series on **Challenging conversations** **February 5th, 2025 from 12–1:00 p.m. ET.**

# Thank You

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